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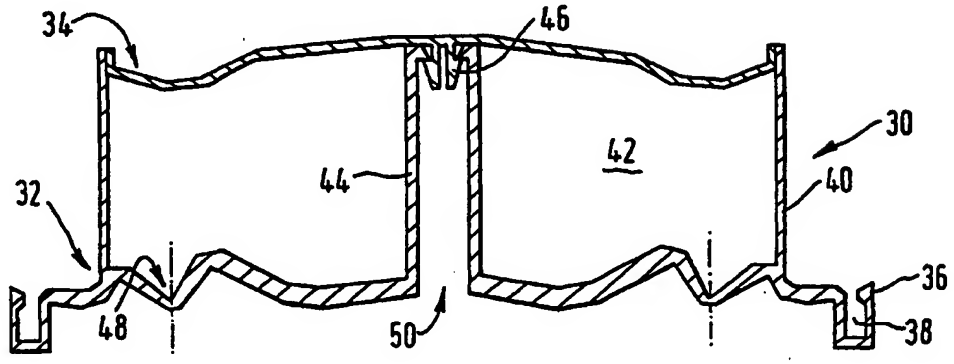


(57) Abstract

A closure (30) for a container is designed to facilitate the mixing of a first material within the container with a second material within the closure at the point of use. The first and second materials are generally chemically reactive. The plastics material closure (30) has a base (32) and a lid (34). The base (32), which is circular, has an annular peripheral rim (36) defining an annular recess (38) by which the closure (30) may be clipped onto a container (10). Radially inwardly of the rim (36) is an upstanding peripheral wall (40) defining a chamber (42) for containing the second material. A plunger (44) is affixed to the base (32) centrally of a convex button (50). When mixing of the first and second materials is required, the container (10) is positioned so that the base (32) of the closure is uppermost, and the button (50) is pressed to move the plunger (44) to push the lid (34) out of the opening of the chamber (42).

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# IMPROVEMENTS IN OR RELATING TO FLUID CONTAINERS

The present invention relates to a fluid container for use as a closure, and to a receptacle having the fluid container as a closure, the receptacle and closure containing first and second materials which are to be mixed for use.

There have been many proposals for self-heating or self-cooling beverage containers. WO 96/29255, for example, discloses a can having the same external dimensions and shape as conventional beverage cans, but having an indented base to define an external cavity in which means to cool or heat the contents of the can are received.

Heating or cooling of the contents of the can can be achieved by using two chemical reactants which are stable when separated, but which produce an exothermic reaction or an endothermic reaction when mixed. US patent No. 5,626,022 shows just one example, from many, of an insert for a self-heating or self-cooling can which enables mixing of the reactants when required. This construction, as is common, utilises a breakable or pierceable barrier to separate the two reactants and spikes or other piercing means to break the barrier when their reaction is required to heat or cool the can.

Many examples of such inserts have been proposed, but none of them have been found to be entirely satisfactory. The designs are often overly complicated, or do not withstand normal transport and handling, or are prone to failure. The manufacturing costs of such devices, which normally have a number of components, are also high.

The present invention sought to overcome the problems noted with the existing inserts for self-cooling and self-heating containers.

According to a first aspect of the present invention there is provided a fluid container for use as a closure, the fluid container comprising a base, a peripheral wall upstanding from the base and defining a chamber for containing fluids, the free end of the peripheral wall defining an opening of the chamber, and a lid received within said opening to tightly close said chamber, and the fluid container further comprising means operable by pressing the base to push the

lid out of its tightly closed position to enable exit of fluid from the chamber.

Although the fluid container was developed specifically for use with self-cooling or self-heating beverage containers, it is utilisable as a closure for a receptacle for a first material which it is required to mix with a second material contained in the fluid container. The first and second materials, which are to be mixed at the point of use, may be chemically reactive.

A closure of the invention will find wide applicability as it is simple to manufacture, and is robust, and is generally fail proof. What is more, the simple action of pressing the base enables the contents of the fluid container to be mixed with the contents of a receptacle closed by the closure.

For example, hair dyes and hair perming agents are required to be rendered active at the point of their application to hair. This is done by reacting a first chemical with the rest of the formulation. The first chemical may be housed in a fluid container of the invention, and that fluid container used to close a tube or bottle containing the rest of the formulation. The base of the closure is pressed when it is required to use the hair dye or hair perming agent to enable mixing of the first chemical from the fluid container with the rest of the formulation.

In a totally different sphere, using a closure of the invention in conjunction with a paint can, for example, will enable paint of one colour, contained in the fluid container, to be mixed with paint of another colour kept in the paint can. By this means, for example, a fluid container of the invention would allow a paint comprising a selected mix of two colours to be made available.

A fluid container of the invention is primarily suitable to contain fluids, but may be utilised in any situation where the mixing of a fluid material with other materials, and/or a chemical reaction is required at the point of use.

In a preferred embodiment, the closure is intended for use with a self-cooling or self-heating beverage container. In this embodiment, the fluid container contains a first chemical reactant, and the second chemical reactant is received within a receptacle formed by an external cavity of the beverage

container, for example, as described in the aforementioned International publication No. WO 96/29255. The fluid container of an embodiment of the invention forms the closure of this external cavity.

Preferably, a closure of an embodiment of the invention is arranged to clip onto the base of the beverage container such that it acts to close its external cavity. Alternatively, the closure may be mechanically connected to the container by other means, for example, by a screw connection.

Preferably, the base of the fluid container is provided with a peripheral rim, and said upstanding peripheral wall is arranged on the base inwardly of the peripheral rim.

The peripheral rim may be appropriately shaped, for example, to clip onto the base of the beverage container.

Although a fluid container of the invention may be of any required peripheral shape, in a preferred embodiment the fluid container is circular. In this case, the peripheral rim is annular. An annular groove may be defined in the base, radially inwardly of the peripheral rim, and arranged to receive a base edge of the beverage container.

In an embodiment of a circular fluid container of the invention, the peripheral wall is arranged radially inwardly of the peripheral rim and defines a substantially cylindrical, fluid containing chamber. The opening of the chamber defined by the free end of said wall is substantially circular.

For efficient operation, the lid of the fluid container must close the fluid containing chamber tightly enough to prevent leakage of fluid during transport and/or handling either of the fluid container separately or of the container when used as a closure for other receptacles and containers.

For many applications it has been found that the provision of a lid which snap fits into the chamber opening is sufficient.

In a preferred embodiment of the fluid container, which is particularly

applicable where a liquid such as water is to be contained within the chamber, the periphery of the lid is formed with an upstanding rim arranged to engage within the opening of the chamber.

Preferably, the inner surface of the lid and its peripheral rim are shaped such that any increase in the pressure of the fluid within the chamber tends to urge the rim into closer contact with the opening of the chamber.

Additionally and/or alternatively, one or more circumferential ribs are provided to extend around the rim of the lid.

It has been found that such circumferential ribs are effective to prevent leakage of liquid from the chamber, for example, by capillary action.

Other means to hold the lid in its tightly closed condition may additionally and/or alternatively be provided. For example, the lid may be hingedly connected to the opening of the chamber. It is also possible to fix or clip part of the lid to a structure upstanding from the base of the fluid container. In a preferred embodiment, this structure comprises a plunger forming said means to push the lid out of its tightly closed position.

In a preferred embodiment, a fluid container of the invention is used as the closure for an external cavity opening in the base of a beverage container. In that situation, gravity can assist in keeping the integrity of the container before self-heating or self-cooling thereof is required, and gravity can also be used to facilitate the self-heating or self-cooling operation.

Thus, for a self-heating container where water is housed in a fluid container of the invention, and lime is housed within the external cavity of the beverage container the weight of the lime tends to act, in normal circumstances, on the lid of the fluid container in a direction to keep the chamber closed.

When it is required to self-heat the beverage container, it is inverted to provide access to the base of the closure which is then pressed to push the lid of the fluid container out of its tightly closed position to release the water and begin the chemical reaction. In this case, it is generally only necessary to move

the lid sufficiently to form a gap for the water contained within the container to discharge. Once a flow of water is established, its weight and gravity will act to open the lid more fully.

Although gravity will assist in the opening process, such that initial full opening of the lid is not necessary, it is preferred for said means to push the lid to be capable of opening the lid by an appreciable amount.

In a preferred embodiment, a plunger affixed to the base and upstanding therefrom is in contact with the lid such that depression of the base adjacent the plunger causes the plunger to push the lid out of its tightly closed position.

Preferably, the plunger is arranged substantially centrally of the base.

The plunger may be affixed to the base alone or to both the base and the lid. In a preferred embodiment, the plunger is integrally formed with the base and is clipped or otherwise engaged with the lid.

In a preferred embodiment, the plunger is mounted on the base by way of a button formed in the base. This button may be a separate structure provided in the base. Preferably, however, the button is moulded integrally with the base.

In a preferred embodiment, the button is defined by an annular groove and has a domed shape. Normally, the dome is convex, but pressure thereon causes a over-centre movement reversing the curvature of the dome. This pushes the plunger carried thereby towards the lid and is very effective in pushing the lid out of its tightly closed position.

The present invention also extends to a container for facilitating mixing of first and second materials, said container comprising a receptacle for the second material, and a closure for closing the receptacle and for containing the first material, wherein the closure comprises a fluid container as defined above.

The first and second materials may be chemically reactive.

In one implementation, the closure is arranged to clip onto the receptacle.

Alternatively, the closure may be arranged to be mechanically connected to the receptacle, for example, by a screw connection.

If the receptacle is a simple can or similar container, the closure will be used in its top opening such that the base of the closure will define the top of the can.

Preferably, the base of the fluid container is provided with a peripheral rim, and said upstanding peripheral wall is arranged on the base inwardly of the peripheral rim.

The peripheral rim may be appropriately shaped, for example, to clip onto the receptacle.

Although the receptacle may be of any required peripheral shape, in a preferred embodiment both the receptacle and its closure have a substantially circular periphery. In this case, the peripheral rim is annular and may define an annular groove receiving an edge of the receptacle.

In an embodiment where the receptacle is circular, the peripheral wall of the closure is arranged radially inwardly of the peripheral rim and is arranged to define a substantially cylindrical, fluid containing chamber. The opening of the chamber is also substantially circular.

According to a further aspect of the present invention there is provided a self-heating or a self-cooling container having an external cavity for containing material for the self-heating or self-cooling process, the external cavity being closed by a closure which comprises a fluid container as defined above.

The present invention extends to a self-heating or a self-cooling container having a tubular peripheral wall, a top member closing one end of the peripheral wall, and a base member closing the other end of the peripheral wall, an internal cavity for the contents of the container being defined within the peripheral wall, wherein the base member is indented to define an external cavity which extends within the peripheral wall but is separated from the internal cavity, said container further comprising a closure for said external cavity, said closure having a fluid

container closed by a lid which extends within and across said external cavity, and wherein said closure further comprises means operable to push the lid out of its closed position whereby contents of the fluid container are released into said external cavity.

Embodiments of the present invention will hereinafter be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 shows, partly in section, a self-heating or a self-cooling beverage container illustrating an external reactant cavity thereof and a closure for the cavity,

Figure 2 shows a larger view of the closure in its closed position,

Figure 3 shows the closure of Figure 2 after opening thereof, and

Figure 4 shows an alternative embodiment of the closure.

The invention will be described hereinafter with reference to a self-heating or a self-cooling beverage container. However, the closure of the invention, which is described below, finds general application wherever it is required to package first and second materials such that they are separated initially but are then mixed at the point of use. Generally, the first and second materials will be chemically reactive.

The beverage container shown in Figure 1 may be a metal or plastics material beverage container 10 having a substantially cylindrical peripheral wall 12 which is closed at one end by a top member 14. As described in WO 96/29255, a base member 16 of the container is indented to define an elongate external cavity 20 which extends within the peripheral wall 12. It will be appreciated that the peripheral wall 12 and the top and base members 14 and 16 of the container together define an internal cavity 22 in which the beverage is received. It will be seen that the external cavity 20 extends within this internal cavity 22, but is separated therefrom by the wall of the base member 16.

The container 10 illustrated in Figure 1 is configured to have the same external dimensions and shape as a conventional beverage can. This means that the can can be filled and treated on existing filling lines.

The external cavity 20 of the can 10 is to be utilised to contain a first

reactant material. Where the can is a self-heating can, for example, the cavity 20 will be filled with quicklime (calcium oxide). The cavity 20, incorporating the quicklime, is closed by a closure of the invention generally referenced 30. For the self-heating can, for example, this closure 30 will contain water.

When it is required to heat the contents of the can 10, the can is inverted and stood on its top member 14 so that the base of the closure 30 is accessible. A button, described below, on the bottom of the base is depressed whereby a water chamber 42 within the closure 30 is opened so that water from the closure 30 flows over the quicklime in the reactant cavity 20 to cause the exothermic reaction. The steam which is generated is allowed to vent around the periphery of the closure 30 through vents or recesses (not illustrated) formed in either the periphery of the closure 30 or in the wall of the cavity 20 or in both. The user will retain the can in its inverted position until the exit of steam has been completed. At this stage the contents of the can will have been heated to a satisfactory temperature.

Figure 2 shows the closure 30. In the embodiment illustrated, the closure is moulded from plastics material and comprises a base member generally indicated as 32 and a lid generally indicated as 34. The base member 32 comprises a substantially circular base having an annular peripheral rim 36. This rim defines an annular recess 38 which enables the closure 30 to be clipped onto the base of the can 10. Radially inwardly of the peripheral rim 36 is an upstanding peripheral wall 40 which defines a generally cylindrical chamber 42 for containing the water. The free end of the wall 40 defines a circular opening of the chamber 42 in which the lid 34 is received. At its centre, the base 32 has an upstanding plunger 44. In the embodiment illustrated, this plunger 44 has an open top end for receiving a fixing 46 of the lid 34.

The plunger 44 is affixed to the base centrally of a button 50 defined within the base 32 by an annular groove 48. It will be seen that in the condition shown in Figure 2, the button 50 is convex and is radially inwardly of the annular groove 48.

The fixing 46 of the lid 34 comprises downwardly extending projections 46 which are clipped into the top of the plunger 44 after the chamber 42 has been

filled with water. It will be seen that the lid 34 also has an upstanding rim 56 (Figure 3) which, when the lid 34 is snap fitted into position, is received within the opening defined by the upstanding wall 40. The lid 34 is also shaped radially inwardly of the rim 56 in a manner such that any pressure generated within the chamber 42 tends to force the rim 56 into tighter contact with the internal surface of the opening of the chamber 42. If required circumferentially extending ribs (not illustrated) may be formed on the exterior of the rim 56, such that they thereby come into contact with the internal surface of the opening of the chamber 42. It has been found that such circumferential ribs prevent capillary action, and hence leaking of water from the chamber 42.

It has been found that where the lid 34 is a good snap fit within the opening of the chamber 42, leakage of water from the closure during normal transport and handling does not occur. Thus, when a closure as 30 is clipped onto a can 10 as shown in Figure 1 it acts to keep the quicklime within the cavity 20 and to retain the water in the chamber 42 but reliably separated from the quicklime.

When self-heating of the can 10 is required it is inverted as described above. The button 50 is pressed. The button 50 is arranged to have an over-centre action such that, as indicated in Figure 3, on depression, the button moves from its initial convex domed position to a substantially concave domed position. Preferably, the button is stable in both of its states. This movement of the button 50 moves the plunger 44 in a direction to push the lid 34 out of the opening of the chamber 42. Generally, it is expected that depression of the button 50 will cause a positive opening of the lid 34 of the chamber 42 whereby water is quickly released into the quicklime of the cavity 20 to commence the self-heating reaction. However, because the container 10 is inverted, it does not matter if positive and full opening of the lid does not occur. In this respect, as long as there is some opening of the lid, flow of the water from the chamber 42 will begin and this will, in itself, tend to ensure fuller opening of the lid.

It is not necessary for the lid 34 to be fixed at its centre to the plunger 44 although this does make a particularly secure and robust construction. Thus, the plunger may simply abut the lid in the closed position of Figure 2.

The contents of the chamber 42 are, if the lid 34 is held captive to the plunger 44 as in the illustrated embodiment, confined to run out from the chamber 42 around the periphery of the lid 34. This makes the illustrated container suitable for use only with materials which flow, for example liquids, powders and other fluids.

The self-heating container described and illustrated can be filled on conventional filling lines, and the contents thereof may be subjected to any treatments required. Thereafter, it is a simple matter to invert each completed and filled container, fill its external cavity with an appropriate charge of quicklime, and then clip on a closure which is already filled with water. Generally, it is preferred to simply clip the closure 30 onto the container 10, but it would be possible to adhere or seal it into position if preferred.

When the closure 30 is subsequently opened to commence the reaction to heat the container, it is possible for water to be pushed out of the cavity 20 towards the rim 36 of the closure. Whilst it is required to have a pathway to vent air and steam, it is not generally required for any water to leak out, even at this stage. Accordingly, a wick, gasket or washer, or semi-permeable membrane (not shown) may be housed in the annular recess 38 or sited around the wall 40 of the closure 30. Additionally and/or alternatively, the closure 30 may be a tight fit on the container, and micro grooves (not shown) may be in the annular recess 38 and/or around the wall 40. If the micro grooves are of the order of 6 thou to 10 thou (thousandths of an inch) they will allow air and steam to vent, but not allow the escape of water.

Figure 4 shows an alternative embodiment of the closure 30. In the embodiment illustrated in Figure 4 features of the closure which are the same or similar to features of the closure shown in Figures 2 and 3 have been accorded the same reference numerals.

The closure 30 of Figure 4 is arranged to vent air and steam through the centre thereof. This may be as an alternative to, or additional to, the peripheral venting described above. Thus, in the embodiment of Figure 4, a vent 60 extends through the fixing 46 of the lid 34. The plunger 44 is hollow and thereby defines an air and steam passageway from the external cavity 20 to the exterior

of the can 10. Preferably, the passageway contains filter material 62 to prevent egress of water whilst allowing air and steam to exit. The filter material 62 will also act to prevent ingress of water and other contaminants from atmosphere into the external cavity 20.

It will be appreciated that venting of air and steam will generally be required upon depression of the button 50 because of the consequent reduction in volume within the closure 30. Thereafter, venting becomes necessary as a result of the chemical reaction during which air is heated and thereby expanded. Normally heating as a result of the reaction continues after air and steam has been vented.

It is preferred that the closure be made of a plastics material. Presently it is preferred that the plastics material be opaque so that the water within the closure 30 is not visible.

It is proposed that external surfaces of the closure and/or of the container 10 be made of, or coated with, materials having thermochromic properties. In this way, if the closure has been operated to cause self-heating of the can at any time, this is immediately apparent by, for example, a change in the colour of part of the closure and/or of part of the container 10.

In one embodiment, the lid 34 of the closure 30 is made of a plastics material with a melting point which is sufficiently low that it is melted by the heat of the exothermic reaction of the water and the quicklime. By this means the hydrating/expanding lime may be readily accommodated within the thereby expanded external cavity 20.

It will be appreciated that modifications to or variations of the embodiments described and illustrated may be made within the scope of this application.

## CLAIMS

1. A fluid container for use as a closure, the fluid container comprising a base, a peripheral wall upstanding from the base and defining a chamber for containing fluids, the free end of the peripheral wall defining an opening of the chamber, and a lid received within said opening to tightly close said chamber, and the fluid container further comprising means operable by pressing the base to push the lid out of its tightly closed position to enable exit of fluid from the chamber.

2. A fluid container as claimed in Claim 1, wherein the closure is arranged to clip onto a receptacle to close a cavity therein.

3. A fluid container as claimed in Claim 1 or Claim 2, wherein the base of the fluid container is provided with a peripheral rim, and said upstanding peripheral wall is arranged on the base inwardly of the peripheral rim.

4. A fluid container as claimed in Claim 3, wherein said peripheral rim is appropriately shaped to clip onto a receptacle to close a cavity therein.

5. A fluid container as claimed in Claim 3 or Claim 4, wherein the fluid container is circular, and the peripheral rim is annular.

6. A fluid container as claimed in Claim 5, wherein an annular groove is defined in the base, radially inwardly of the peripheral rim.

7. A fluid container as claimed in any preceding claim, wherein the fluid container is circular, and wherein the peripheral wall is arranged radially inwardly of the peripheral rim and defines a substantially cylindrical, fluid containing chamber.

8. A fluid container as claimed in any preceding claim, wherein said lid snap fits into the chamber opening.

9. A fluid container as claimed in any of Claims 1 to 7, wherein the periphery of the lid is formed with an upstanding rim arranged to engage within the opening of the chamber.

10. A fluid container as claimed in Claim 9, wherein the inner surface of the lid and its peripheral rim are shaped such that any increase in the pressure of the fluid within the chamber tends to urge the rim into closer contact with the opening of the chamber.

11. A fluid container as claimed in Claim 9 or Claim 10, wherein one or more circumferential ribs are provided to extend around the rim of the lid.

12. A fluid container as claimed in any preceding claim, further comprising a plunger affixed to the base and upstanding therefrom, the plunger being in, or near, contact with the lid such that depression of the base adjacent the plunger causes the plunger to push the lid out of its tightly closed position.

13. A fluid container as claimed in Claim 12, wherein the plunger is arranged substantially centrally of the base.

14. A fluid container as claimed in Claim 12 or Claim 13, wherein the plunger is integrally formed with the base and is clipped or otherwise engaged with the lid.

15. A fluid container as claimed in any of Claims 12 to 14, wherein the plunger is mounted on the base by way of a button formed in the base.

16. A fluid container as claimed in Claim 15, wherein the button is moulded integrally with the base.

17. A fluid container as claimed in Claim 15 or Claim 16, wherein the button is defined by an annular groove and has a domed shape.

18. A container for facilitating mixing of first and second materials, said container comprising a receptacle for the second material, and a closure for

closing the receptacle and for containing the first material, wherein the closure comprises a fluid container as claimed in any preceding claim.

19. A container as claimed in Claim 18, wherein the first and second materials are chemically reactive.

20. A container as claimed in Claim 18 or Claim 19, wherein the closure is arranged to clip onto the receptacle.

21. A container as claimed in any of Claims 18 to 20, wherein the receptacle is a can, and the closure is used in the top opening of the can such that the base of the closure will define the top of the can.

22. A container as claimed in any of Claims 18 to 21, wherein both the receptacle and its closure have a substantially circular periphery, and wherein the peripheral rim of the closure is annular and defines an annular groove receiving an edge of the receptacle.

23. A self-heating or a self-cooling container having an external cavity for containing material for the self-heating or self-cooling process, the external cavity being closed by a closure which comprises a fluid container as claimed in any of Claims 1 to 17.

24. A self-heating or a self-cooling container having a tubular peripheral wall, a top member closing one end of the peripheral wall, and a base member closing the other end of the peripheral wall, an internal cavity for the contents of the container being defined within the peripheral wall, wherein the base member is indented to define an external cavity which extends within the peripheral wall but is separated from the internal cavity, said container further comprising a closure for said external cavity, said closure having a fluid container closed by a lid which extends within and across said external cavity, and wherein said closure further comprises means operable to push the lid out of its closed position whereby contents of the fluid container are released into said external cavity.

25. A fluid container for use as a closure substantially as hereinbefore described with reference to the accompanying drawings.

26. A container for facilitating mixing of first and second materials substantially as hereinbefore described with reference to the accompanying drawings.

27. A self-heating or a self-cooling container substantially as hereinbefore described with reference to the accompanying drawings.

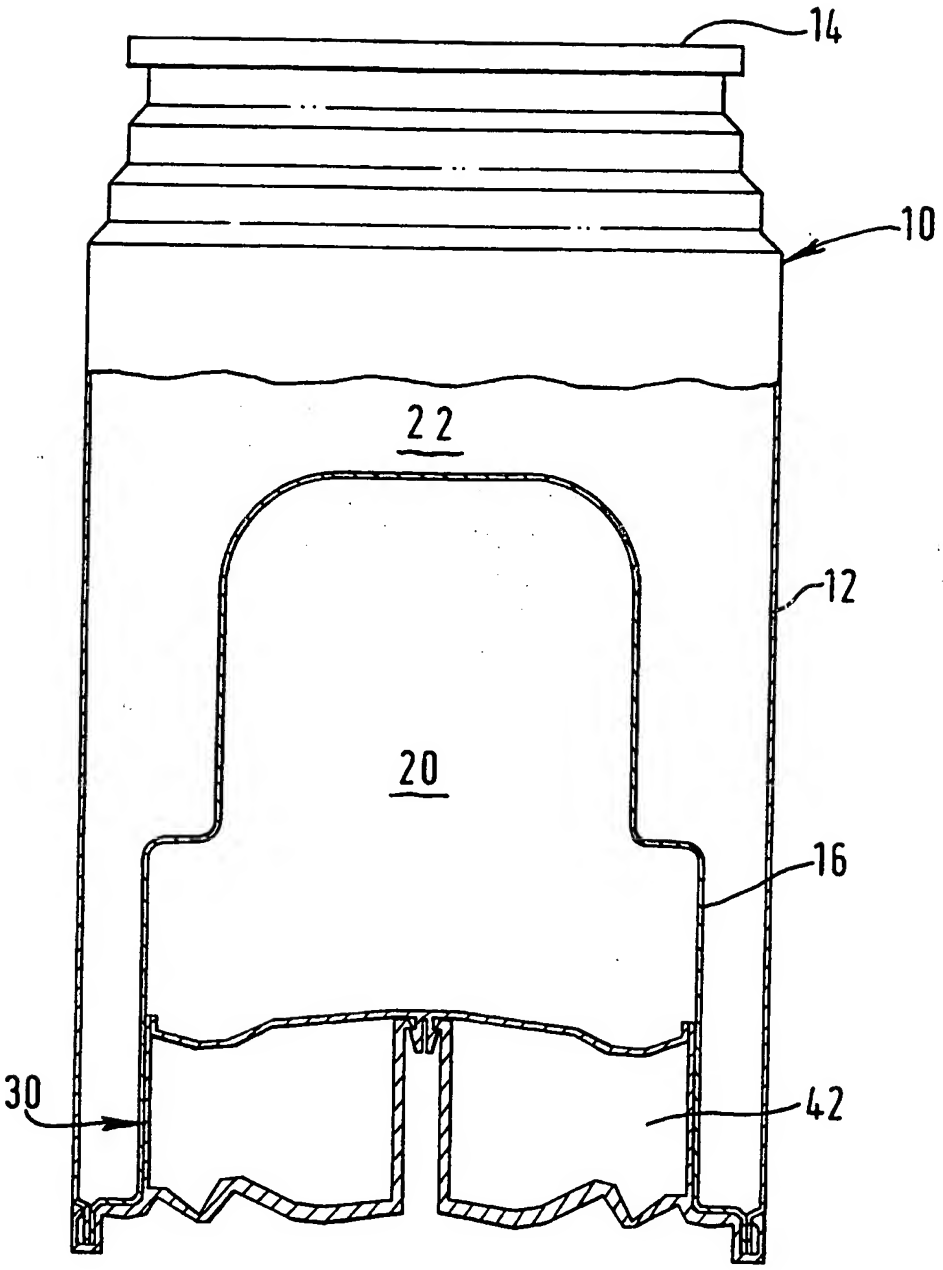


FIG. 1.

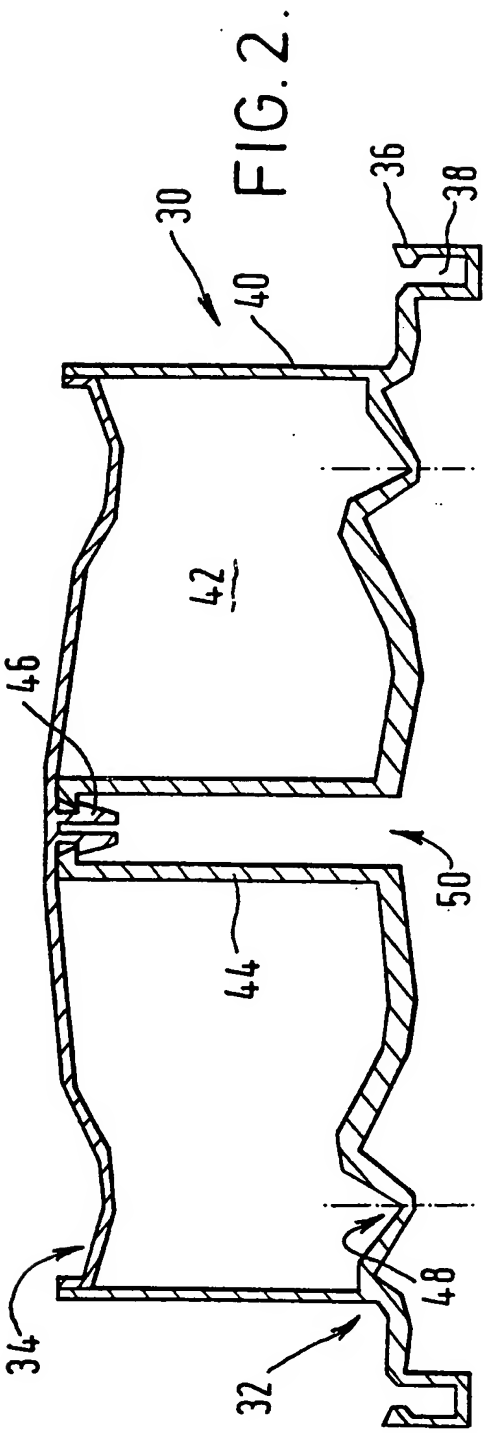


FIG. 2.

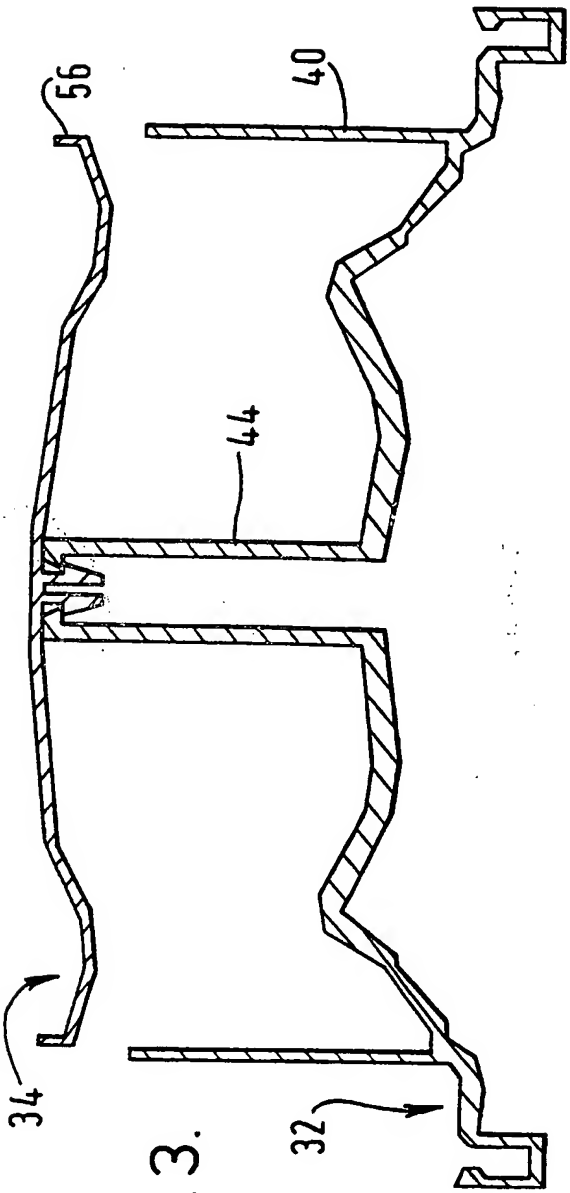


FIG. 3.

FIG. 4.